How China's Aid Helps Recipient Countries Build Export Capacity

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Abstract: *Based on data of China's aid to 120 countries and recipient countries' export data between 2002-2014, this paper investigated the export effects of China's aid. We found that China's aid was conducive to recipient countries' exports to China, helping recipient countries boost their development capacity and meet China's consumption demand at the same time. In this manner, China's foreign aid has lived up to the principle of "mutually beneficial cooperation". Heterogeneity test found that China's aid helped recipient countries increase their exports of manufacturing goods of their comparative advantage, mainly medium- and low-end manufacturing products, to China without increasing the exports of non-manufacturing goods, such as agricultural produce as well as primary and resource goods. Our findings have thoroughly refuted criticisms like the "resource exploitation" narrative by Western countries against China. Apart from increasing African countries' exports to China, China's aid also helped other recipient countries outside Africa, mostly medium- and low-income recipient countries, to export more to China. China's aid-for-trade (AfT) programs did not significantly increase recipient countries' capacity to export to China. A test of the mechanism of action found that industrial development in recipient countries exerted only a partial intermediate effect in enhancing recipient countries' capacity to export to China.*

Keywords: *foreign aid, recipient countries, export capacity, mutually beneficial cooperation*

JEL Classification Codes: F35, P33

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1. Introduction

International aid provides much-needed capital for development and public welfare in recipient countries. With growing national strengths, China has transformed from a recipient to a key contributor of international aid. According to William and Mary's AidData, China's aid between 2000-2014 totaled 354.4 billion US dollars, which was close to the US foreign aid during the same period (394.6 billion US dollars)[4]. Under the Belt and Road Initiative (BRI) and China-Africa economic and trade cooperation, China has established the South-South Cooperation Fund for win-win cooperation among developing

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[1] China did not release detailed information about its foreign aid. With different methods, academics and research institutions have estimated the amount of China's foreign aid. Compared with their results, William and Mary's Aid Data is the most complete and detailed database of China's foreign aid statistics despite apparent overestimates and confusion in the classification of some aid categories. Therefore this paper and many others employ this database to research China's foreign aid.

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countries. China has also aided developing countries and international organizations involved in the BRI. However, China's emergence as a donor country poses challenges to the existing aid system led by the developed world.

China's aid, often combined with economic and trade cooperation, is unlike gratuitous official development aid (ODA) from developed countries. This unique approach of assistance has aroused a great deal of interest in the international community but has raised some eyebrows. Some Western countries accused China of "exploiting" resources from recipient countries. The question is whether China's aid is intended to "exploit" resources from recipient countries or help them foster development capabilities? Answering this question requires an objective and accurate assessment of how foreign aid from China contributed to development in recipient countries.

This paper discusses the effects of China's aid on recipient countries with respect to exports. There are two reasons. Firstly, China's aid is designed to help such countries build up their development capacity. Export is one of the most important capacity for developing countries. China's economic reform and development experiences suggest that exports based on the country's comparative advantages serve as a key growth driver in the early stages of a country's development. For most lower-middle-income developing countries or less developed countries, a sensible approach to promote economic growth would be to export medium- and low-end manufacturing goods based on their comparative advantage. Secondly, it's necessary to reveal "real effects" of China's aid. As criticisms such as the "resource exploitation" narrative stemmed from a lack of transparency in China's aid projects and results, Western countries assessed China's aid effectiveness solely based on the unique cooperation model, accused that China issued loans to recipient countries in exchange for resources like oil and natural produce, but overlooked the long-term effects on the latter's export capacity and growth potentials.

Investigating how China's aid contributed to recipient countries' exports may reveal China's aid development effects. The results will provide empirical evidence against the "resource exploitation" argument. This paper tests the heterogeneous effects of China's aid on the recipient countries' exports to China in terms of the categories of export goods, foreign aid types, and recipient countries' income levels. It also elaborates the mechanism in which China's aid helped industrial development in recipient countries, enabling them to export more to China.

The remainder of this paper is structured as follows: Part 2 offers the related literature on the relationship between international aid and trade. Part 3 provides an econometric model and data explanation. Part 4 presents the results and analysis of empirical estimates. Part 5 is a test of the underlying mechanism. The final section is conclusions and policy advice.

2. Literature Review

Most studies on the effects of aid on trade between aid and recipient countries have focused on the countries that are members of OECD's Development Assistance Committee (DAC). The reason is that developed countries have long dominated aid over the years. Some studies investigated the export effects of ODAs or "aid for trade" (AfT) for recipient countries as an indicator of aid effectiveness. Through a Granger causality test, Lloyd *et al*. (2000) and Osei *et al*. (2004) found various relationships between aid and the donor country's exports to the recipient country. For instance, aid may increase the donor country's exports to the recipient country; two-way causality exists, or no correlation exists between aid and the donor country's exports to the recipient country.

Wagner (2003) found that aid could promote DAC member countries' exports to recipient countries via direct or indirect effects. With Germany's foreign aid and export data between 1978-2011 and a revised gravity model, Martínez-Zarzoso *et al*. (2016) found that aid was conducive to German exports to recipient countries, where each dollar of aid would increase exports to recipient countries by 0.83 US dollars. However, the effects varied across sectors, with machinery, electronics, and transportation

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equipment sectors benefiting the most. Other studies discussed ODA's or AfT's effects on the export of recipient countries. Calì and Velde (2011) found that aid-for-trade programs offered by developed countries reduced the cost of trade for recipient countries, contributing to their export growth, and the effects of aid-for-trade programs varied across sectors. Helble *et al*. (2012) uncovered that OCED countries' aid-for-trade programs also helped recipient countries' exports. Their results suggest that a 1% increase in aid-for-trade facilitation(of about 220 million US dollars in 2008) correlates to about 290 million US dollars of additional exports from the aid receiving countries. With data of 184 countries during the period 1990-2005, Pettersson and Johansson (2013) created country pairs and revealed that foreign aid helped increase the exports of both donor and recipient countries. However, Suwa-Eisenmann and Verdier (2007) considered that foreign aid could also give rise to the "Dutch disease" and "aid dependency effect" in recipient countries, thus undermining their export competitiveness. Examining the effects of aid-for-trade on the export diversity of recipient countries, Huang and Zhu (2015) discovered that aid-for-trade from DAC members led to an increase in the recipient countries' export diversity. This conclusion would be influenced by such factors as aid categories and recipient countries' level of economic development.

Due to limited data, Chinese academics mainly theoretically investigated the history, features, and effects of China's aid; only a few scholars have carried out empirical tests on the relationship between China's aid and China-Africa trade. Liu and Tang (2018) conducted a comparative analysis of the trade effects of China and US aid to Africa. They found that aid from both China and the US helped expand the donor countries' exports to Africa. Through a comparative study on the trade effects of aid from the EU and China, Liu *et al*. (2018) arrived at similar conclusions, i.e. both the EU and China had trade considerations in aiding Africa. That is to say, the accusation by Western countries of China's aid combined with trade and economic cooperation as "neo-colonialism" is unfounded. Based on a study of the effects of aid-for-trade programs, Lemi (2017) uncovered that foreign aid from OECD members had boosted trade growth between donors and African countries, but the trade effects of China's aid and aid for trade were both insignificant. With the time series data of China's aid and trade between 1994-2011, Xiong and Huang (2014) found that aid was conducive to China's trade growth as a donor country. Similar to this paper, Zhu and Huang (2017) and Sun *et al*. (2019) examined the effects of China's aid on the structural shifts in Africa's exports to China and the world. Yet both studies are concerned with African countries and thus cannot reveal the effects of China's aid on the export capacity of all recipient countries.

These related literature shows three characteristics. Firstly, studies on China's aid and the export capacity of recipient countries are relatively few and focused on African countries. There is a paucity of empirical evidence on the export effects of China's aid for all recipient countries and those outside Africa. With the BRI implementation, China's aid is increasingly focused on BRI countries, especially Asian countries, with disparate economic development levels, industrial structure, and categories of aid received. Such heterogeneity makes it necessary to further evaluate the average effects of China's aid on all recipient countries' export capacity, including those outside Africa.

Secondly, existing studies have examined the overall trade or export effects of China's aid from a donor country's perspective, paying less attention to the recipient countries' export effects. In contrast, China's aid is often intertwined with economic and trade cooperation for win-win results, aiming to help recipient countries develop their economies especially through the way of improving exports capacity which is a key growth engine.

Thirdly, the mechanism in which ODAs or aid for trade from developed countries increases recipient countries' exports has been fully demonstrated[2]. There is, however, a paucity of research and empirical evidence on how foreign aid from emerging economies contributes to the export capacity of recipient countries.

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Hence, this paper's marginal contributions are threefold:

(i) It examines how China's aid contributed to the capacity of recipient countries, including African and non-African recipient countries, to export to China, thus broadening the scope of research to all recipient countries of China's aid.

(ii) It uncovers the effects of China's aid on exports of different products from recipient countries to China and offers rigorous empirical evidence for evaluating the effect of China's aid and refuting such criticisms as "resource exploitation" by Western countries.

(iii) It investigates the partial intermediate effects of industrial development in recipient countries on the capacity of recipient countries to export to China based on the empirical evidence that China's aid increased medium- and low-end manufacturing exports from recipient countries to China as well as the intention of China's aid to help recipient countries foster endogenous development potentials in light of their resource and labor endowments.

3. Econometric Model and Data Explanations

3.1 Econometric Model

Consistent with the methods of Magna (2003) and Martínez-Zarzoso *et al*. (2016), this paper creates a revised trade gravity model and a fixed-effects model to investigate the export effects of China's aid on recipient countries. Model specifications are as follows:

$$lnexport_{it}=\alpha_i+\beta_1 lnaid_{it}+\delta Z_{it}+\gamma_t+\varepsilon_{it} \quad (1)$$

Where, i and t denote recipient country and year, respectively; explained variable $lnexport_{it}$ is the total amount of merchandise exports from recipient country i to donor country (China) in year t; core variable $lnaid_{it}$ is the total amount of aid received by recipient country i from China in year t; Z_{it} is a vector of time-varying country characteristics including the recipient country's economic size ($lngdp_{it}$), China's economic size ($lngdp_chn_t$), the recipient country's institutional environment ($institution_{it}$), foreign aid provided by OECD member countries to the recipient country ($lnODA_{it}$), and the level of investment openness of the recipient country ($lnIFDI_{it}$).

To avoid estimation deviation arising from the omission of other variables, this model also includes country (α_i) and year (γ_t) fixed effects. The former helps control the impact of factors that do not change with time on recipient countries' capacity to export to China. Such factors include political correlation (whether the recipient country is a colony of the donor country), distance, language, culture and so on. The latter helps control factors that change over time. The standard errors are clustered at the level of country. ε_{it} is the error term.

3.2 Data Specifications

In this paper, the dependent variable is the size of the recipient country's exports to China (*lnexport*) from the BACI database. It provides bilateral trade flow data at the 6-digit HS industry, including information such as exporting countries, importing countries, products' HS code, prices and so on.

[2] Studies suggest that foreign aid or "aid-for-trade" may influence a donor or recipient country's exports via the following avenues: First, some aid programs are tied to imports from donor countries or contingent upon recipient countries' trade liberalization or economic reforms, thus influencing donor countries' exports in direct or indirect ways (Wagner, 2003; Martínez-Zarzoso *et al*., 2016). Second, aid may compensate for recipient countries' shortfall of savings, prompting them to make more investments that induce economic growth and enhance import capacity. Yet aid may also crowd out private investment in recipient countries, thus impeding their economic development and import capacity (Suwa- Eisenmann and Verdier, 2007). Third, recipient countries may try to maintain friendly ties with donor countries by importing more from donor countries with the aim to receive more aid or "aid-for-trade" programs from donor countries. Aid may also reduce donor countries' cost of export and recipient countries' cost of import, which helps maintain continuity in donor countries' exports to recipient countries (Wagner, 2003).

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Table 1: Descriptive Statistics of Variables

Variable	Observation	Mean	Standard deviation	Min.	Max.
lnexport	1,530	17.525	5.046	0	24.498
lnaid	1,530	8.821	8.578	0	23.999
lngdp	1,530	23.511	1.997	16.872	28.572
lngdp-chn	1,530	29.088	0.583	28.191	29.905
institution	1,530	6.17e-17	1.708	-4.378	5.788
lnODA	1,505	19.417	5.555	0	25.021
lnIFDI	1,454	33.620	3.455	0	39.135

Core independent variable is the amount of China's aid (*lnaid*) from AidData database. It provides unique information about the amount of China's aid by sectors to more than 140 countries or regions in Africa, Central and Eastern Europe, Asia Pacific, Latin America and the Caribbean region over the period 2000-2014. Since the precise amount of aid to individual countries cannot be determined for some aid programs, this paper has deleted such aid programs involving multiple recipient countries. [3] Programs which AidData suggested as inappropriate for research and those with missing aid data have also been deleted.

The recipient country's economic size ($lngdp_{it}$) and China's economic size ($lngdp\text{-}chn_t$) are denoted by their GDP respectively with data from the World Bank's World Development Indicators (WDI) database. With the principal components analysis (PCA) method, we created an institutional environment index ($institution_{it}$) for the recipient country, which consists of six common institutional indicators, including the control of corruption, government effectiveness, political stability and absence of violence/terrorism, regulatory quality, the rule of law, and the right of discourse and accountability. Data are from the World Bank's World Governance Indicators (WGI) database. Foreign aid offered by OECD member countries to recipient country ($lnODA_{it}$) is denoted by the total official development assistance flows (ODA+OOF) with data from the OECD/CRS database. The level of investment openness of recipient country ($lnIFDI_{it}$) is denoted by annual FDI inflows into recipient country with data from UNCTAD database.

Finally, this paper selects 120 countries that received aid from and exported to China over the period 2002-2014 as samples. [4] The amount of exports of recipient countries to China, the amount of aid from China and OECD member countries, recipient countries' GDP and China's GDP, as well as the level of investment openness of recipient countries, have all been converted into the constant US dollar price of 2010 by GDP deflator. Except for factors of institutional environment, all other variables are in logarithmic form. Descriptive statistics of variables are shown in Table 1.

4. Results and Analysis of Empirical Estimation

4.1 Benchmark Regression

Table 2 reports the results of benchmark regression. Column (1) does not control the other variables

[3] Aid programs involving multiple recipient countries are relatively few, accounting for 0.5% of total sample size.

[4] This paper specifies the sample period as 2002-2014 due to missing data of some indicators before 2002. Some Chinese academics have also followed a similar method of treatment in their research on China's aid, e.g., Yang and Li (2018), Dong and Fan (2016) and Liu *et al*. (2018).

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Table 2: Benchmark Regression Results

	(1)	(2)	(3)	(4)	(5)
lnaid	0.043***	0.011*	0.013**	0.013**	0.012**
	(0.005)	(0.050)	(0.034)	(0.012)	(0.017)
lngdp			0.406*	0.406	0.383
			(0.075)	(0.393)	(0.319)
lngdp-chn			1.614***	1.614***	1.602***
			(0.000)	(0.000)	(0.000)
institution			-0.198	-0.198	-0.094
			(0.151)	(0.345)	(0.658)
lnODA			-0.024	-0.024	-0.018
			(0.302)	(0.427)	(0.557)
lnIFDI			0.039*	0.039	0.014
			(0.073)	(0.766)	(0.791)
Country Fixed effects	No	Yes	Yes	Yes	Yes
Year Fixed effects	No	Yes	Yes	Yes	Yes
N	1,530	1,530	1,432	1,432	1,373
adj. R^2	0.005	0.231	0.231	0.295	0.308

Notes: ***, ** and * denote statistical significance levels at 1%, 5% and 10%. The same below.

except the core independent variable, and Columns (2-4) gradually add the fixed effects of country and year, the other control variables, and perform a clustered adjustment for standard deviations at the country level respectively. Column (5) provides the estimated results based on balanced panel data. It can be found that the core explanatory variable' s (*lnaid*) coefficient is significantly positive generally at the level of 5%, which suggests that China's aid led recipient countries to export more to China. [5] This is a win-win result for China and recipient countries. By exporting more to China, recipient countries have deepened their economic and trade relations with China and integrated into the global division of labor. In the context of globalization, export growth helps recipient countries gain more from trade through participation in the global value chain (GVC) and enhance their development potentials or capacity.

In Table 2, the coefficients of recipient countries' economic size (*lngdp*) and China's economic size (*lngdp-chn*) are mostly significantly positive, which means that recipient countries' capacity to export to China is positively influenced by the economic size. The coefficients of recipient countries' institutional environment (*institution*) and foreign aid from OECD countries (*lnODA*) are insignificant, but their signs are roughly consistent with expectations. The coefficient of recipient countries' level of investment openness (*lnIFDI*) is positive, meaning that recipient countries more open to foreign investment are more capable of exporting to China.

4.2 Heterogeneity Analysis

4.2.1 Tests based on export structure

Under the principle of mutual benefits and win-win results, China's aid allows recipient countries

[5] To ensure robust conclusions, this paper also considered the impact of recipient countries' factor endowment on their improvement of export capacity as a result of aid from China. The result does not alter this paper's basic conclusions. Please refer to Table 1 for detailed estimation results. We appreciate reviewers for their valuable opinions.

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to export more to China. Yet this virtuous model of cooperation was accused of "resource exploitation." If China's aid can be proven to have enabled recipient countries to export more industrial goods of their comparative advantage, especially medium- and low-end manufactured goods, rather than agricultural produce, primary goods and natural resources, the "resource exploitation" narrative by Western countries can be proven wrong, and China's aid can be proven to have positive effects on recipient countries' export capacity.

Hence, this paper classifies recipient countries' exports by two methods to uncover how aid from China had influenced exports of various sorts from recipient countries. The first method is to classify a recipient country's exports into two categories including manufacturing and non-manufacturing goods. The other is further to classify manufacturing exports into three categories including primary and resource goods, medium- and low-tech goods, and high-tech goods. Based on export data from the BACI two-way trade database, we aligned 6-digit HS codes with 3-digit ISIC Rev.2 codes and 3-digit SITC Rev.2 codes. Manufacturing goods refer to samples whose ISIC codes are in the range of 300-400 and 4-digit SITC codes are in the range of 5000-9000. Code conversion criteria are from the *Product Codes* document in the BACI database. Following the same criteria as Lall's (2000), manufacturing goods are divided into primary, resource, low-tech, medium-tech and high-tech goods based on 3-digit SITC codes. Primary and resource goods, which reflect a country's resource endowment, are classified as the first category. Low-tech and medium-tech goods are classified as the second category. High-tech goods are classified as the third category.

Table 3 provides the regression results of the heterogeneous effects of China's aid on different types of exports from recipient countries. Columns (1-2) of Table 3 provides the regression results of how China's aid had influenced recipient countries' non-manufacturing and manufacturing exports. It can be found that the coefficient of the core variable (*lnaid*) in Column (2) is significantly positive at 5%, i.e. China's aid spurred the manufacturing export of recipient countries to China without any significant positive effect on non-manufacturing, such as agricultural exports.

Since manufacturing goods contain primary and resource goods, dividing recipient countries' exports into manufacturing and non-manufacturing exports cannot fully refute the "resource exploitation" narrative. This paper further divided manufacturing goods to examine the effects of China's aid on different types of exports with estimated results shown in Columns (3-5) of Table 3. The coefficient of the core explanatory variable (*lnaid*) is positive only for medium- and low-tech goods. The implication is that China's aid only exerted significantly positive effects on medium- and low-tech exports in which recipient countries boasted comparative advantage without contributing to their exports

Table 3: Tests Based on Export Structure

	(1)	(2)	(3)	(4)	(5)
	Non-manufacturing goods	Manufacturing goods	Primary and resource goods	Medium- and low-tech goods	High-tech goods
lnaid	0.0001	0.011**	0.005	0.010*	0.008
	(0.991)	(0.036)	(0.402)	(0.080)	(0.187)
Control variable	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
N	1,432	1,432	1,436	1,436	1,436
adj. R^2	0.222	0.211	0.283	0.250	0.212

Note: Numbers in parentheses are P statistics based on standard errors clustered at the country level. The same below.

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of primary and resource goods and high-tech goods. In this manner, we have proven that China's aid was not intended to extract resources from recipient countries. Instead, China has helped recipient countries enhance their endogenous development potentials based on their resource endowments. Such assistance is consistent with recipient countries' industrial structure and development trends.

4.2.2 Tests based on the geographical location of recipient countries

Since the founding of the People's Republic of China in 1949, China has extensively aided Africa and many other countries and regions[6]. Since African countries are major recipients of aid from China and China's aid to Africa steadily increased under the Forum on China-Africa Cooperation (FOCAC), studies by Chinese and international academics on China's aid effectiveness have focused on African recipients. The question is whether China's aid would generate similar export-enhancing effects for non-African countries?

To answer this question, we divided recipient countries into African and non-African countries to assess the heterogeneous effects of China's aid on the export capacity of recipient countries in those regions. Results are shown in Table 4. Columns (1) and (5) provide the effects of China's aid on the export capacity of African and non-African countries. It can be found that the coefficient of the core explanatory variable (*lnaid*) in Column (1) is significantly positive, i.e. China's aid helped African countries export more to China. This finding is consistent with Liu and Tang's (2018) conclusions. The coefficient of the core explanatory variable of (*lnaid*) in Column (5) is also significantly positive, meaning that China's aid generated similar effects for non-African countries, i.e. China's aid also helped non-African recipient countries export more to China. Since the coefficient of the core explanatory variable for African countries is greater than that for non-African countries, the average export effects of China's aid are greater for African countries than for non-African countries.

Western countries' "resource exploitation" narrative mainly refers to the "Angola model" under which petroleum and other natural resources are collaterals for the cooperation between China and African countries, in which the recipient countries' total exports contain manufacturing goods that include primary and resource goods. To refute criticisms by Western countries and demonstrate the positive effects of China's aid on recipient countries' endogenous development, this paper further examined the heterogeneous effects of China's aid on various exports of African and non-African countries with results shown in Table 4. Columns (2-4) and (6-8) provide the effects of China's aid

Table 4: Tests Based on the Regional Distribution of Recipient Countries

	African countries				Other countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnaid	0.016*	-0.010	0.021*	0.015	0.011**	-0.002	-0.001	0.001
	(0.084)	(0.395)	(0.071)	(0.130)	(0.036)	(0.802)	(0.887)	(0.904)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	569	537	537	537	895	895	895	895
adj. R^2	0.289	0.217	0.313	0.284	0.310	0.222	0.321	0.270

[6] According to calculations based on the aid data provided by the AidData database, the amount of aid provided by China to African countries from 2002 to 2014 accounted for about 40% of the total aid.

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on the export of primary and resource goods, medium- and low-tech goods and high-tech goods from African and non-African recipient countries. It can be found that the coefficient of the core explanatory variable (*lnaid*) in Column (3) is significantly positive, but the coefficient of the core explanatory variable (*lnaid*) in other columns is insignificant. That is to say, China's aid helped African countries export medium- and low-tech goods without any significant effect on the export of primary and resource goods. This indicates that China's aid helped African countries manufacture and export medium- and low-tech goods based on their comparative advantage instead of exploiting resources like petroleum. China's aid did not lead to an increase in the export of petroleum and other resource goods from non-African countries.

4.2.3. Tests based on recipient countries' income levels

The export effects of China's aid for recipient countries may also be influenced by the level of economic development in recipient countries. There are differences in the amounts and sectors of China's aid to countries at different income levels. For medium- and low-income recipient countries, China's aid is more generous and focused on infrastructure construction, manufacturing and technology cooperation. For high-income countries, China's aid mostly went to other social infrastructures, education, healthcare, NGOs and government organizations and seldom involved infrastructure and aid-for-trade sectors. Most high-income countries in our samples are island and resource-rich countries with few comparative advantages for manufacturing development. China's aid did little to benefit their export capacity.

According to the World Bank's criteria for classifying high-income, middle-income and low-income countries (2010), [7] we divided recipient countries into medium- and low-income countries (including low-income countries, lower middle-income countries and upper middle-income countries) and high-income countries to evaluate the heterogeneous effects of China's aid on the export capacity of countries with different income levels. Results of estimation are shown in Table 5. Columns (1-2) show the export effects of China's aid for medium- and low-income countries, and Columns (3-4) show the export effects of China's aid for high-income countries. It can be found that the coefficient of the core explanatory variable (*lnaid*) for medium- and low-income countries is significantly positive, i.e. China's aid mainly benefited the export capacity of medium- and low-income recipient countries with insignificant effects

Table 5: Classified Tests by Recipient Countries' Income Levels

	(1)	(2)	(3)	(4)
lnaid	0.032***	0.011**	0.076*	0.036
	(0.000)	(0.028)	(0.083)	(0.245)
Control variable	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	No	Yes
N	1,431	1,344	91	80
adj. R^2	0.017	0.314	0.156	0.543

[7] According to the World Bank's criteria (2010), low-income countries refer to countries with per capita national income below 1,005 US dollars, lower middle-income countries refer to countries with per capita national income in the range of 1,005-3,975 US dollars, and upper middle-income countries refer to those with per capita national income in the range of 3,976-12,275 US dollars. High-income countries refer to those with per capita national income above 12,276 US dollars.

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on the capacity of high-income recipient countries to export to China.

4.2.4 Tests based on aid categories

Tariff rates, which fell sharply over recent years, no longer present a barrier for countries to participate in the global value chain (GVC). Yet trade cost has emerged as main barrier to trade. In 2005, the WTO launched the "Aid for Trade" Initiative to help developing countries, especially the least developed countries (LDCs), lower export cost and increase trade-related supply and infrastructure to promote exports. As a proactive participant in the "Aid for Trade" Initiative, China has undertaken to ramp up aid for trade. The question is how much China's aid-for-trade programs has benefited recipient countries?

To answer this question, we divided China's aid into "aid-for-trade" (*lnaid_AfT*) and "non-aid-for-trade" (*lnaid_nAfT*) categories to test how different categories of aid from China had helped recipient countries export to China. China's "aid-for-trade" data is not directly available. Chinese and international academics have yet to agree on the definition of aid for trade to emerging economies. Referencing Lemi (2017), we identified aid for transportation, telecommunications, healthcare, trade, tourism, and education as proxy variables for China's aid-for-trade programs with estimated results shown in Table 6. Columns (1-2) provide the export effects of China's aid-for-trade and non-aid-for-trade programs for recipient countries. It can be found that the coefficient of the core explanatory variable (*lnaid_nAfT*) in Columns (2) is significantly positive. The implication is that China's non-aid-for-trade programs could have contributed the most to the export-enhancing effects of China's aid for recipient countries.

As a late mover of aid-for-trade programs, China offered a relatively small amount of aid for trade,[8] for which statistics are lacking. China's aid for trade is not found to have significantly boosted recipient countries' exports to China. Given the importance of China-Africa relations and the focus of relevant literature on the export-enhancing effects of aid for trade for African countries, we excluded non-African recipient countries and retained only African country samples to further evaluate how China's aid for trade helped African countries' exports, with results in Column (3) of Table 6. It can be found that China's aid for trade did not increase African countries' capacity to export to China as well. This result is consistent with Lemi's (2017) research conclusions.

Table 6: Tests by Aid Categories

	(1)	(2)	(3)
lnaid_AfT	0.009		0.013
	(0.148)		(0.176)
lnaid_nAfT		0.010**	
		(0.025)	
Control variable	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
N	1,432	1,432	509
adj. R^2	0.294	0.294	0.207

[8] Compared with non-aid-for-trade programs, China's aid-for-trade accounted for less than 20% of China's total foreign aid.

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4.3 Robustness Test

4.3.1 Re-estimation of China's aid

In the preceding section, we have evaluated China's aid by the amount of aid offered. To ensure robust conclusions, we further employed aid amount per capita (*aidshare_pcap*), aid amount as a share of recipient country's GDP (*aidshare_gdp*), the dummy variable of foreign aid (*aid_dum*) and the stock of aid amount (*lnaid_s*) to re-depict China's aid[9] and test the export effects of China's aid for recipient countries. Results are shown in Columns (1-4) of Table 7. It can be found that under whichever method, the coefficient of the core explanatory variable is generally significantly positive at 10%, i.e. China's aid boosted recipient countries' exports to China. This conclusion is robust.

4.3.2 Dynamic effects

Considering that a recipient country's exports in the current period may be related to its export behaviors in the past, we included a lag value for the amount of the recipient country's exports to China and employed the systemic GMM method to estimate the regression equation with results shown in Column (5) of Table 7. It is found that the coefficient of the core explanatory variable (*lnaid*) remains

Table 7: Robustness Test

	(1)	(2)	(3)	(4)	(5)	(6)
L.lnexport					0.466***	
					(0.000)	
lnaid					0.006**	0.860***
					(0.023)	(0.001)
aidshare_pcap	0.0002**					
	(0.022)					
aidshare_gdp		0.014*				
		(0.093)				
aid_dum			0.238***			
			(0.006)			
lnaid_s				0.036***		
				(0.009)		
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	772	772	1,432	1,432	1,168	645
adj. R^2	0.339	0.339	0.296	0.299		0.398
Sargan test					0.1270	
P value of AR (2) test					0.1648	

Note: P value of AR (2) test reports P values related to second-order autocorrelation.

[9] Since previous aid programs may have continuous effects on recipient countries' exports, we aggregated various tranches of aid from China to recipient countries over the years to construct a "stock" indicator of foreign aid and examine the long-term dynamic effects of China's aid on recipient countries' exports to China. We appreciate reviewers' valuable contributions.

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significantly positive. The implication is that after controlling for the dynamic factor of recipient countries' capacity to export to China, China's aid still helped recipient countries export more to China, and the result is robust. Arelleno-Bond's serial correlation test suggests that the null hypothesis cannot be statistically rejected, i.e. second-order serial correlation does not exist.

4.3.3 Endogeneity problem

Since China would not select recipient countries randomly, China is more likely to offer aid to its trading partners, thus giving rise to the problem of endogeneity. Given the potential political interests behind China's aid, countries politically close to China are more likely to receive aid from China. Political relations, however, are not directly related to recipient countries' exports to China. Referencing Sun *et al*. (2019), we employed China's vote favorability index among recipient countries from the United Nations General Assembly (UNGA) vote database as an instrumental variable[10] and employs 2SLS method for a test. Results of estimation are shown in Column (6) of Table 7. It can be found that after the potential problem of endogeneity is taken into account, China's aid has still exerted significantly positive effects on recipient countries' exports to China, and the result is robust.

5. Mechanism of Action

The above study suggests that China's aid helped recipient countries export more to China. Yet theoretical and empirical evidences are lacking with respect to the mechanism in which China's aid helped recipient countries enhance their export capacity in the related literature. In its foreign aid programs, China has been committed to helping recipient countries foster growth potentials by virtue of their domestic resource and labor endowments. China is committed to helping recipient countries improve their industrial structures and strengths. China's aid has helped recipient countries' export of industrial goods, especially medium- and low-end manufacturing goods to China. That is to say, China's aid may have played an important role in facilitating industrial development in recipient countries. We therefore measure the mediating effects based on the intermediary variable (i.e. recipient countries' industrial development) using equations (1)-(3):

$$lnind_{it} = b_i + b_1 lnaid_{it} + \theta Z_{it} + \gamma_t + \varepsilon_{it} \quad (2)$$

$$lnexport_{it} = c_i + c_1 lnaid_{it} + c_2 lnind_{it} + \mu Z_{it} + \gamma_t + \varepsilon_{it} \quad (3)$$

Where, is expressed by the logarithm of per capita value-added of the recipient country's industrial sectors (including construction sector) (in constant 2010 US dollars). It measures the level of industrial development in the recipient country. Data source is also the World Bank's World Development Indicators (WDI) database. The definitions of other variables are the same with the above.

Table 8 provides the estimated results of the mediating effects . Columns (2) and (3) are the estimated results of equations (2) and (3), and Column (1) shows the estimated results of equation (1). Hence, we duplicated Column (4) of Table 2 into Column (1) of Table 8 without additional explanations. It can be found that the coefficient of the core variable (*lnaid*) in Column (2) is significantly positive, i.e. China's aid exerted positive effects on the per capita value-added of industrial sectors in recipient countries, helping them raise industrial productivity. China's infrastructure and technology assistance to recipient countries has helped them make simple and crude industrial processes more intensive. Column (3) provides the regression results of the dependent variable with respect to independent and intermediary

[10] The election favorability index (jointvotes2) of China among its aid recipient countries is an integrated index based on s2un (binary favorability index) and agree2un (vote similarity index). It measures China's favorability among other countries in international politics. Source of UNGA voting data: https://dataverse.harvard.edu.

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Table 8: Tests of the Mechanism of Action

	(1)	(2)	(3)
	lnexport	*lnind*	*lnexport*
lnaid	0.013**	0.001*	0.010*
	(0.012)	(0.088)	(0.055)
lnind			0.990***
			(0.000)
Control variable	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
N	1,432	1,251	1,251
adj. R^2	0.295	0.210	0.269

variables. It can be found that the coefficients of the core explanatory variable (*lnaid*) and intermediary variable (*lnaid*) are both significantly positive, i.e. industrial development enhanced recipient countries' comparative advantages and helped them export more to China. Compared with Column (1), the coefficient of the core explanatory variable (*lnaid*) in Column (3) significantly decreased, i.e. recipient countries' industrial development exerted a partial intermediate effect in increasing the export-enhancing effect of China's aid.

6. Conclusions and Policy Advice

This paper analyzed how China's aid helped recipient countries export more to China based on the recipient countries' export data and China' aid. It also offered empirical evidence of China's aid effects to refute such criticisms like the Western countries' "resource exploitation" narrative. Our findings suggest that China's foreign aid helped recipient countries export more to China, which is mutually beneficial for both sides. Heterogeneity test shows that:

(i) From the export structure's perspective, China's aid helped recipient countries export manufacturing goods (especially medium- and low-end manufacturing goods) conforming to their comparative advantage, without increasing the export of agricultural produce, primary and resource goods. In this manner, our findings have thoroughly refuted such criticisms as the "resource exploitation" argument in the international community, demonstrating the positive role of China's aid in helping recipient countries develop their economies by virtue of their domestic resource and labor endowments.

(ii) From the recipient countries' perspective, China's aid helped recipient countries, whether in Africa or elsewhere, export more to China, benefiting medium- and low-income recipient countries the most.

(iii) In terms of aid categories, China's non-aid-for-trade programs helped recipient countries export more to China. However, aid-for-trade programs exerted insignificant effects on China's exports to recipient countries. This conclusion still holds true for African recipient countries.

The mediating effects showed that China's aid helped recipient countries export more to China by the channel of spurring industrial development in host countries. Namely, industrial development in recipient countries exerted a partial intermediate effect on the contribution of China's aid to recipient countries' capacity of exporting to China.

The following policy recommendations can be derived from our study:

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(i) Such criticisms as the "resource exploitation" narrative made by Western countries regarding China's aid are inconsistent with the reality. China's aid programs have been mutually beneficial both for China and recipient countries. Research on the effectiveness of China's aid programs should be increased and communicated to stress their essential role in helping recipient countries develop their economies.

(ii) As late movers in foreign aid, emerging economies have adopted different aid approaches from developed countries' traditional ODA. The lack of relevant statistical indicators for emerging economies' "aid-for-trade" programs prevented Chinese and international academics from performing in-depth research on "aid for trade" issues. With the rapid development of foreign aid from emerging economies led by China, it is vital to create a system of indicators reflecting foreign aid characteristics from emerging economies referencing similar indicator systems of the WTO and OECD members. Data about China's aid-for-trade programs also needs to be updated for the domestic public and the international community regularly in order to evaluate the effectiveness of aid-for-trade programs objectively. China should gradually increase the share of aid-for-trade programs in total aid to help recipient countries participate in global trade and develop their economies through this mechanism.

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Annex:

Considering that factor endowment may affect our conclusions, we further added the factor endowment of recipient countries into the control variables of equation (1), including recipient countries' total labor force (*labor*), total investment volume (*capital*), and per capita arable land area (*land*), which measure recipient countries' labor, capital and natural resource factor endowments expressed in logarithmic form. Data is from the World Bank's World Development Indicators (WDI) database with results shown in Annex Table 1.

With the control variables, Columns (1-2) gradually included the fixed effects of country and time, and Column (3) offers the estimated results based on the balanced panel data (see Table 2). Significance level remains more or less the same, demonstrating the robustness of the conclusion that China's aid had boosted recipient countries' capacity to export to China

Annex Table 1: Robustness Test Based on Factor Endowment

	(1)	(2)	(3)
lnaid	0.010**	0.009*	0.009*
	(0.034)	(0.050)	(0.062)
lngdp	0.035	-0.148	-0.160
	(0.912)	(0.678)	(0.655)
lngdp_chn	1.318***	1.705***	1.671***
	(0.000)	(0.000)	(0.000)
institution	-0.273	-0.203	-0.173
	(0.296)	(0.473)	(0.549)
lnODA	-0.054***	-0.054***	-0.053***
	(0.000)	(0.001)	(0.001)
lnIFDI	0.135	0.107	0.115
	(0.122)	(0.216)	(0.196)
labor	0.735	0.738	0.590
	(0.404)	(0.417)	(0.501)
capital	0.010	-0.001	0.060
	(0.970)	(0.996)	(0.837)
land	0.676	1.022	0.884
	(0.803)	(0.714)	(0.750)
Country fixed effect	Yes	Yes	Yes
Year fixed effect	No	Yes	Yes
N	1075	1075	1063
adj. R^2	0.332	0.337	0.334

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